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ABSTRACT

This paper discusses the poor preparation of children with disabilities in math and science fields, and the perception that students with disabilities are not capable of doing work in science and math, which is often reinforced by teachers and parents. It is argued that the low expectations and waived requirements for children with disabilities are preventing children with disabilities from gaining a solid foundation in math and science. The need for children with disabilities to be trained on adaptive technology to enable them to meet basic math and science requirements in college is addressed, as well as methods for making elementary and secondary math and science text books accessible to students with disabilities. Methods include having a staff member or teacher act as a reader, providing brailled materials, audio recordings of text books, and digital audio, which combines standard electronic texts with digitized recording of a human reader. Mainstreaming students with disabilities and advocating for appropriate services are also briefly discussed. (CR)

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EASI STREET TO SCIENCE AND MATH FOR K-12 STUDENTS

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Providing children with disabilities a solid foundation in basic skills is the single-most important aspect of ensuring that they can enter and succeed in college and the work place. This is especially true in the math and science fields, as students must fully understand the fundamentals before they can move on to advanced study or work. Children who are not properly prepared, children who do not build strong foundations, children who are moved along when they have not mastered the basics, are almost certainly doomed to failure. There are several basic issues facing students with disabilities.

First, there is an attitude among teachers, administrators, and sometimes even parents, that students with disabilities can't "do" math or science.

Second, students with disabilities are often waived out of math and science course work in K-12, which means that they don't develop the basic foundational skills in these fields. This also makes it impossible for many students with disabilities to meet national standards in science and math.

Third, students with disabilities are not getting adequate training on adaptive computing technology.

Fourth students with disabilities who are studying science and math face problems finding math and science texts that are accessible.

Fifth, students with disabilities often require extra help in making the transition from one level of education to the other and from the educational setting to the workplace.

Sixth, students with disabilities and their parents must learn to advocate for the appropriate technology and other accommodations necessary for them to succeed in education and the workplace.

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NEGATIVE ATTITUDES AND AWARENESS ISSUES

The negative attitudes that K-12 students with disabilities face parallel those that adults with disabilities

face. A 1989 study by the National Science Foundation (Changing America, 1989) reported that the single most significant barrier faced by individuals with disabilities is the negative attitudes on the part of faculty and employers. This is particularly harmful because not only does it deny or limit some students' entrance into the fields of science, engineering and math, but it almost ensures that those individuals will never be able to enter science, engineering, mathematics or technology-related careers when they enter the workforce.

Parents, teachers and service providers can do a great deal to help students face and debunk those negative attitudes. Often, all it takes to get teachers, administrators and parents to believe that students with disabilities can do math and science is to show them the tools and accommodations available.

LOWERED EXPECTATIONS AND WAIVED REQUIREMENTS

The perception that students with disabilities are not capable of doing work in science and math is often reinforced by teachers and parents. Too often students with disabilities are not held responsible for the work that is being done by their peers, and teachers from preschool on will often have lower expectations for students with disabilities. Many teachers in the early grades are so pleased that a student with a disability can do any of the class work. "She is just amazing," is the attitude. And "We don't want to make her work harder than her friends" is the justification for lowering expectations and waiving requirements for students with disabilities. Unfortunately, many parents buy into this argument as well.

Some schools have been experimenting with extending the time that elementary and secondary schools provide for students with disabilities to learn basic skills. This can include doing one year's worth of work in two years' time. However, some parents and teachers have raised the issues of the importance of having students move ahead with their social groups and of the perception that retention is only for students who are in real trouble at school. Perhaps it's time to rethink the issue and convince parents, teachers and school administrators that more time to master the basics is a likely option for many students with disabilities.

ADAPTIVE TECHNOLOGY - A NECESSARY FOUNDATION

K-12 students with disabilities must be trained on adaptive technology as early and as much as possible. A basic foundation in using computers and special applications to make the computers accessible is critical for disabled children if they are to move into higher education and the workplace.

Adaptive computing technology, also called assistive technology, has two important uses. The first is to adapt general computers so that they are usable by people with disabilities. The second application is to use computers as compensatory tools. In this way, a person might use a computer to accomplish tasks that aren't usually performed on computers.

Students will need to meet basic math and science requirements in college, whether they specialize in those fields or not. It's difficult to introduce students to specialized adaptive technology at the same time that they're trying to get through a math or science class, which they may find difficult. Students who are taking the math or science as part of their core requirements, rather than as a major, have a particularly tough time learning special math or science software programs, and students who don't have a good math foundation are fighting a three-way battle.

MAKING K-12 MATH AND SCIENCE TEXT BOOKS ACCESSIBLE

Although a considerable amount of K-12 education comes through direct personal instruction in a classroom setting, much of the educational experience depends on the use of text books, both in the classroom and at home. For students with disabilities, a major concern is the availability of accessible text books. This issue becomes even more important when we talk about accessible science and math texts for K-12 students.

A variety of methods may be used to supply access to these texts. A common practice for in-school work is the assignment of a staff member or teacher to act as a reader, while home reading may be provided by a family member or a care-giver. This usually works well for young students who cannot utilize printed materials due to their disabilities, but who have intact hearing.

Since young students are using very basic materials, and have only a slight reading load, this strategy is usually sufficient. However, as the reading load and complexity increases with the student's progress through school, this approach begins to lose effectiveness. Additionally, dependence on a reader adversely affects a student's ability to independently discover and utilize books that have not been assigned by teachers, but that are needed to satisfy the natural craving for knowledge. Finally, the average reader may not have the technical expertise to effectively read higher level math and science texts.

Brailled materials are a common approach for students who have little or no usable sight, but have reasonable dexterity. Braille is also a perfect match for a student who is both deaf and blind. Although Brailled materials work very well for the lower grades, some textbook materials do not lend themselves well to Brailling, such as higher level math and physics. Also, large textbooks are very expensive to produce in Braille, which compounds availability problems. Schools for the blind typically Braille their own materials for the early grades, or students may use Brailled materials available through the American Printing House for the Blind (APH). Mainstreamed students who do not attend specialized schools, however, will sometimes find little school support for Braillling services.

Audio recordings on four-track cassette tapes are presently the most common form of accessible texts used in the higher grades. Recording for the Blind and Dyslexic (RFB&D) is the major provider of audio text books for students in grades 4- 12, in addition to supplying textbooks at the undergraduate and graduate levels. RFB&D has also begun an effort to increase holdings of audio books for grades K-3.

In earlier years, audio recordings for the youngest students were not deemed appropriate as it was feared that this would interfere with a student's ability to learn Braille. However, due to a quickly growing user-base of very young students who are not blind but who have severe learning disabilities, RFB&D has begun recording books for these very early grade levels as well. In the math and science area, RFB&D has benefited in the past from grants from the National Science Foundation and a number of private foundation grants that have been earmarked for expanding the collection of math, science and technology texts in the college and upper grade levels, though many books are also available at the lower and middle grade levels. Currently, there are about 2,500 math and science texts in RFB&D's library that are designed for K-12 use.

A new technology on the horizon which may be particularly useful for making math and science texts more accessible to students with disabilities is digital audio. In its most powerful form, digital audio combines standard electronic texts with digitized recordings of a human reader. This means that a user would have the full searching power available in an electronic text format, while also having the benefits of true voice reading. Since standard electronic text formats are unsuitable for use with math and science books containing numerous graphs, equations, and diagrams, digital audio will make these kinds of books accessible at a level never before achieved with either Braille or audio cassette. Although the digital audio format is very new, it shows great promise for making math and science text books more

accessible than ever before imagined.

TRANSITIONS AND MAINSTREAMING

When a student moves from one educational setting to another, it is a time of anxiety. If that student has a disability, the anxiety is multiplied. The new environment may have to be physically adapted. New classmates will have questions, and new teachers will need information on how to best help a student with a disability progress and become an interdependent part of the new classroom or school.

One of the main issues facing parents of children with disabilities is whether or not to allow their children to be mainstreamed - put into regular school classrooms. Many people see it as an equality issue. Others see it practically - some children aren't able to learn what they need to learn in regular classes.

Whether or when children with disabilities are mainstreamed into the general school population is an issue that must be addressed for each child. Some students do just fine entering the general population at a young age. Others benefit by going to special classes for a few years and then moving into mainstream classes. The important thing is to make sure that mainstreaming is right for the individual child, rather than being done as a policy decision.

ADVOCACY

Many parents agree that the most trying thing about having a child with a disability is the fight to get services and an appropriate education for their child. And that's why developing advocacy skills is so important. Parents and the students themselves must work to find what is legally mandated, to find the resources available, and to successfully lobby for the services they need. There are hundreds of organizations, funds and laws that support services for students with disabilities. The problem is that getting appropriate services doesn't usually happen automatically. And even though teachers and service- providers are almost always well-meaning, they can sometimes be unaware of what is necessary to support a particular student. Then it's up to the parents and the students themselves to make people aware of what their needs are.